

# Mould Remediation Decision Tree

## I think I have mould in my cultural heritage collection- what now?

### What is this decision tree for?

Finding a mould outbreak or planning for mould remediation in a cultural heritage context can seem complex and perhaps daunting, particularly while addressing issues of health and safety. This document provides a straightforward method for approaching remediation by indicating a practical order for the most pertinent steps.

### What is this decision tree NOT for?

- This is not a disaster preparedness plan, or guidance for emergency situations.
- This decision tree does not address preventative conservation measures used to avoid mould growth in the first place, or specific how to manage causative agents of mould after an outbreak occurs (e.g. flood, fire, air, or water systems causing moisture, etc.). These must be addressed to prevent ongoing mould growth.

### What information does this decision tree provide?

- It reframes mould remediation (which may feel like a chaotic process) through a project management lens.
- Identifies the most pertinent steps in the remediation process.
- Includes some links to further information, which are current at time of publication.

The decision tree should be used in conjunction with the **Mould Thresholds of Cleanliness** (what's necessary in mould remediation?) and **Mould & Health Risk Diagram** (Is it safe? - achieving Threshold 1, in detail). See <https://canadianconservationconsortium.ca/en/mould-levels/> for the documents and further information.

### Personal Protective Equipment (PPE)

During all stages of mould identification and remediation, it is necessary to protect staff and anyone else coming into contact with mould.

Consult mould literature and salvage literature<sup>1</sup> for advice on recommended levels of protection. This generally means wearing Personal Protective Equipment which is appropriate to the scale of the mould outbreak or where fouled water may have been in contact with the collection items.

Individuals with certain health risks may be advised not to work with contaminated materials. Large outbreaks may require consulting/employing health and/or salvage professionals to ensure safe working procedures.

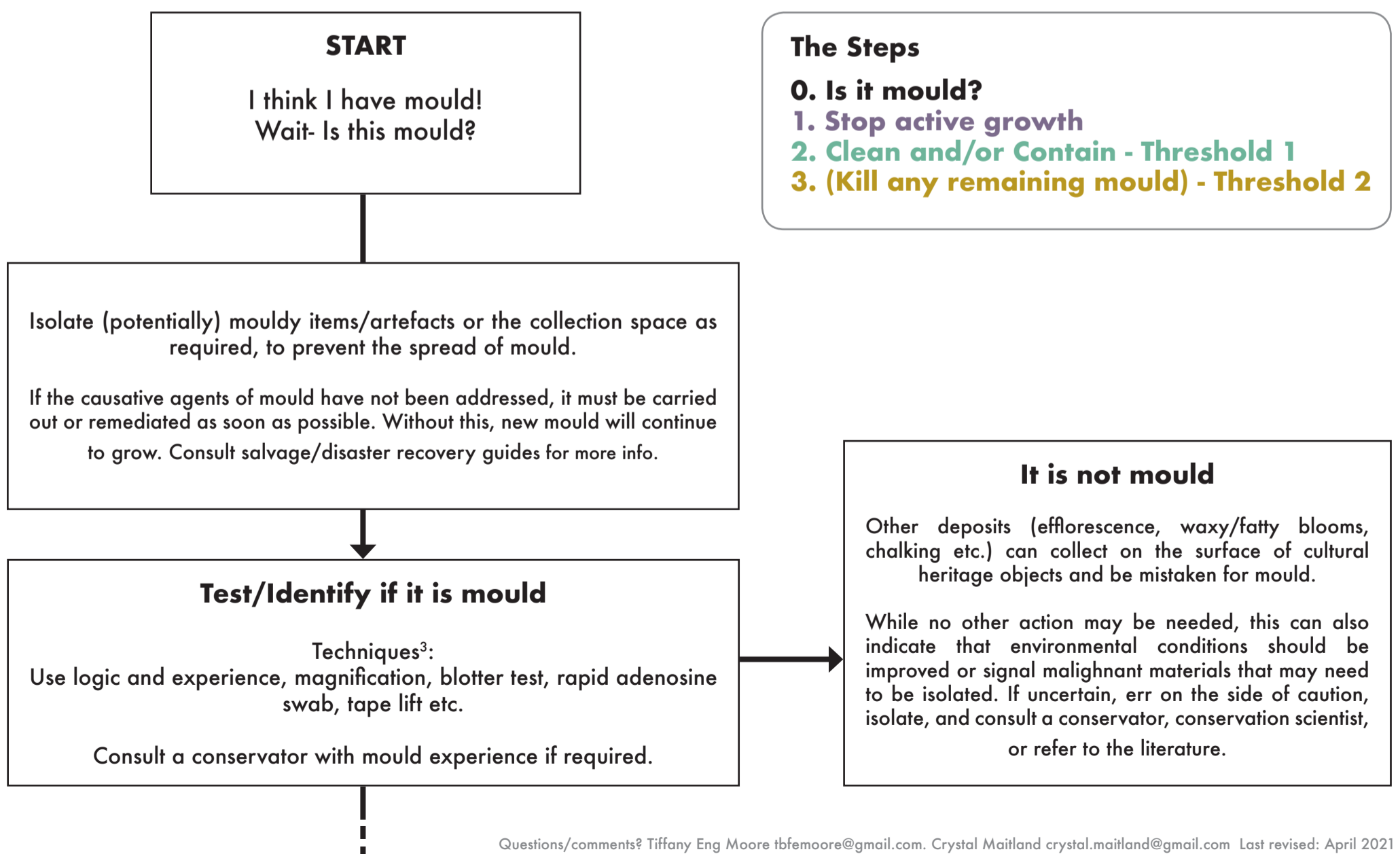
### Isolating mouldy material

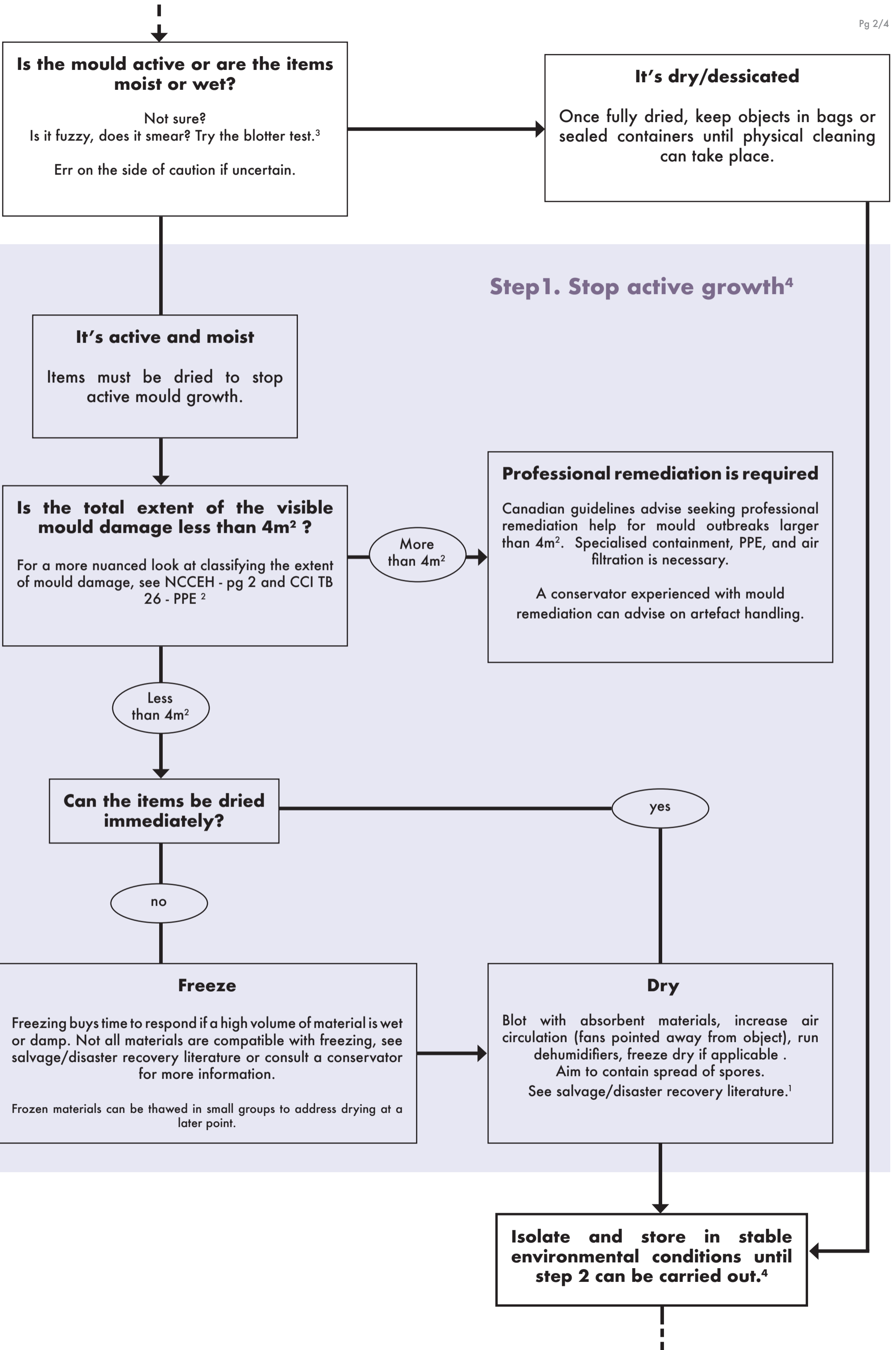
During all stages where mould may be present, items/artefacts must be isolated to prevent the potential spread of mould.

Bag, wrap or box affected items in transport and storage as appropriate. For large outbreaks, the collection area(s) may need to be isolated.

Moist or wet items, and items with actively growing mould should be isolated during transport. This is a temporary measure until items can be dried.

To prevent the spread of mould particulates, conduct all cleaning in a fume hood or biosafety cabinet. If these are not available, cleaning can be done in a room with all return air vents blocked and windows open. Weather permitting, working outdoors (away from building air intakes) under cover is an option.





**Step 1. Stop active growth<sup>4</sup>**

**Is the mould active or are the items moist or wet?**  
Not sure?  
Is it fuzzy, does it smear? Try the blotter test.<sup>3</sup>  
Err on the side of caution if uncertain.

**It's dry/dessicated**  
Once fully dried, keep objects in bags or sealed containers until physical cleaning can take place.

**It's active and moist**  
Items must be dried to stop active mould growth.

**Is the total extent of the visible mould damage less than 4m<sup>2</sup> ?**  
For a more nuanced look at classifying the extent of mould damage, see NCCEH - pg 2 and CCI TB 26 - PPE <sup>2</sup>

More than 4m<sup>2</sup>

**Professional remediation is required**  
Canadian guidelines advise seeking professional remediation help for mould outbreaks larger than 4m<sup>2</sup>. Specialised containment, PPE, and air filtration is necessary.  
A conservator experienced with mould remediation can advise on artefact handling.

Less than 4m<sup>2</sup>

**Can the items be dried immediately?**

yes

no

**Freeze**  
Freezing buys time to respond if a high volume of material is wet or damp. Not all materials are compatible with freezing, see salvage/disaster recovery literature or consult a conservator for more information.  
Frozen materials can be thawed in small groups to address drying at a later point.

**Dry**  
Blot with absorbent materials, increase air circulation (fans pointed away from object), run dehumidifiers, freeze dry if applicable. Aim to contain spread of spores.  
See salvage/disaster recovery literature.<sup>1</sup>

**Isolate and store in stable environmental conditions until step 2 can be carried out.<sup>4</sup>**

## 2. Clean and/or Contain - Threshold 1 (necessary) → Minimise health effects/spread of mould

**Remove as many loose mould fragments and spores from surface as possible, balancing with care of delicate (digested) artifact surfaces.**

**Contain or encapsulate material that is too fragile to be adequately cleaned (in a manner that will permit long term storage and access).**

- Using a HEPA vac is a recommended first step as it reduces the amount of mould particulates released into the air. See CCI TB 26<sup>2</sup> for details.
- Secondary cleaning with sponge erasers or other surface cleaning techniques. Aqueous/solvent cleaning techniques may also be helpful for removing additional mould particulates from artefacts with medium to severe mould damage, or where the artefact substrate is fragile.

**Have I cleaned/contained it enough? Is it safe?**

Use *Mould and Health Risk Diagram* for determining if Threshold 1 has been achieved to a sufficient level.

The diagram includes suggestions for cases where cleaning is not sufficient or appropriate.

Note: An aqueous/solvent disinfecting technique such as 70:30 Ethanol/Water solutions may straddle Threshold 1 and 2 → solvent application meant to kill mould BUT also removes additional mould residues.

**Carry out step three (Threshold 2) if possible and/or desired.**

## 3. (Kill any remaining mould) - Threshold 2 (additional) → Address future viability of embedded mould

**Carrying out an additional fungicidal technique to kill any remaining mould in the artefact will ensure the same mould does not again grow on the artefact. However, mould from new sources will still be able to grow if suitable environmental conditions occur.**

Consult the literature<sup>2</sup> for advice as many fungicidal techniques have health risks or may cause severe damage to the artefact. These risks, along with the time/cost to perform that treatment must be weighed against the benefits of that treatment on a case-by-case basis.

### Salvage and disaster recovery resources <sup>(1)</sup>

**British Library Preservation Pamphlets (UK) - Salvaging Library and Archive Collections; Mould Outbreaks in Library and Archive Collections**

<https://www.bl.uk/conservation/guides#>

**Museum of London (UK) - Pocket Salvage Guide**

<https://www.museumoflondon.org.uk/supporting-london-museums/specialist-support/collections/e-learning-tools>

**Northeast Document Conservation Centre (USA)- Emergency Management Leaflets**

<https://www.nedcc.org/free-resources/preservation-leaflets/overview>

**General mould resources**

Canadian Conservation Consortium resource page [author website]  
<http://canadianconservationconsortium.ca/en/resources-mould-heritage-collections/>

### Mould resources Canada <sup>(2)</sup>

**Canadian Conservation Institute- Mould Prevention and Recovery: Technical Bulletin 26**

<https://www.canada.ca/en/conservation-institute/services/conservation-preservation-publications/technical-bulletins/mould-prevention-collection-recovery.html>

**National Collaborating Centre for Environmental Health - Mould (non-heritage)**

<https://ncceh.ca/environmental-health-in-canada/health-agency-projects/mould>

**National Collaborating Centre for Environmental Health - Mould Remediation Recommendations (non-heritage)**

<https://ncceh.ca/documents/guide/mould-remediation-recommendations-revised>

**Check for local and provincial guidance documentation and remediation advice.**

## Some mould identification techniques <sup>(3)</sup>

It is generally sufficient to simply identify whether it is mould, and whether or not the mould growth is active. Genus or species identification of mould is often unnecessary as remediation steps remain the same regardless of the species. All moulds are assumed to be hazardous on some level as human health reactions vary so widely.

Actively growing mould is generally straightforward to identify. It is usually fuzzy/velvety (white or coloured), grows in circular patches, and will smear if touched. Check for signs of humidity or water damage.

Blotter test for active mould: use a microspatula to lift a small piece of the potential mould onto a thin blotter, check for moisture released (with or without magnification).

Dried and non-active mould may look similar to dust and dirt. Dust and dirt will have obvious points of ingress from the exposed, outside or edges of an item, inward. E.g. Circular 'dirty' patches near the gutter of a book is more likely to be mould than dirt, especially if there are signs of water or high humidity (cockling, staining, rust), and no obvious pathway for dust and dirt to have entered. Mould is also likely to be in similar locations across the item(s) (ie. a series of book pages with similar damage).

Magnification: magnification of between 40x and 200x are often suitable to notice hyphae and branching patterns which are characteristic of mould.

Tape lift: taking a tape lift (strong intact surfaces only) and place on a slide, check under magnification as above.

Biological/fungal swab tests (e.g. rapid adenosine; Mycometer Surface ®): swabs designed for recognising general organic matter or mould specific enzymes.

## Resources

Sanmartin, Patricia, Alice DeAraujo, and Archana Vasanthakumar. 'Melding the Old with the New: Trends in Methods Used to Identify, Monitor, and Control Microorganisms on Cultural Heritage Materials.' *Microbial Ecology* 76, no. 1 (July 2018): 64–80.

Sequeira, S, E.J Cabrita, and M.F Macedo. 'Antifungals on Paper Conservation: An Overview'. *International Biodeterioration & Biodegradation* 74 (October 2012): 67–68.

Strang, Thomas J.K, and John E. Dawson. 'Controlling Museum Fungal Problems'. Technical Bulletin. Ottawa, Canada: Canadian Conservation Institute (CCI), 1991.

## Retaining mould damaged material <sup>(4)</sup>

Mould remediation is a time and resource intensive activity. Curatorial and collections management guidance can ensure the damaged material requires retention. For example, general collections library books may be better suited by replacement. PPE and biosafety measure can permit staff to perform triage before mould remediation occurs.